# Foundations for the Future:

## *A Brief History of Air Force Civil Engineers*

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*The emblem of the Aviation Engineers*

Air Force Civil Engineers have a proud heritage tracing back to before World War I. Originally, the engineering function was a small unit of the Army Signal Corps and construction was handled through the Office of the Chief Signal Officer. When the Air Service was established in 1918, the Building and Grounds Branch of the Division of Military Aeronautics inherited maintenance and construction responsibility (in conjunction with the Construction Division of the War Department) for ten flying schools, one repair depot, and five balloon schools. In 1921, construction of Air Service projects was turned over to the Construction Service, Quartermaster Corps, working closely with the Air Service (later Air Corps) Building and Grounds office. Throughout the 1930s, the Air Corps continued to slowly expand. The availability of Works Progress Administration (WPA) funds facilitated construction that otherwise would not have been undertaken by the Air Corps. In 1940, construction of Army Air Corps facilities in the Zone of Interior was transferred to the Corps of Engineers. For construction overseas, a new type of engineering organization was established.

## World War II

Long before Pearl Harbor, the growing Army Air Forces indicated the vital need for engineers specialized in the building of airfields overseas in support of tactical and strategic air operations. The Air Forces needed its own engineers; troops who trained with it, spoke its language, and understood its needs. These men were to be trained and equipped to rapidly construct advanced airfields close to or even behind enemy lines. They were also to be trained to improve and maintain the existing facilities. They were to be skilled in the camouflage of airfields and the construction of defensive works. They were to be organized and prepared to repair airfields damaged by enemy bombing. Finally, with their trained riflemen and machine gunners, they were to be prepared to take an active part in the defense of their airdromes. Such was the concept of the Aviation Engineers--troops who were trained to construct, conceal, maintain, and defend airfields.

In June 1940, a handful of officers and 80 enlisted men assembled at Fort Benning, Georgia, to form the 21st Engineer (Aviation) Regiment, the first of its kind and the parent unit of the more than 100,000 Aviation Engineers who served in WWII. Originally established with 27 Engineer officers and 761 enlisted men, each Aviation Engineer battalion was programmed for a lavish amount of equipment, including 220 items for construction and 146 vehicles--diesel tractors with bulldozers, carryall scrapers, graders, gasoline shovels, rollers, mixers, air compressors, drills, trucks, trailers, asphalting and concreting equipment, rock crushers, draglines, and pumps--for its mission. To protect themselves from air and ground attack, the Aviation Engineers were trained and equipped for combat as well as construction. They were armed with a variety of weapons including bazookas, antitank and antiaircraft guns, grenade launchers, armed half-tracks, antitank mines and a full complement of small arms.

In addition to the regular Aviation Engineer battalions, 16 Airborne Aviation Engineer Battalions were organized in 1943. These

*An airborne engineer uses a miniature bulldozer to lengthen a runway at Tamu, Burma. (U.S. Air Force photo)*

*Brig Gen James B. Newman, commander, IX Engineer Command (U.S. Air Force photo)*

specialized units were designed to parachute in ahead of other airborne troops, patch up captured airfields or construct a new one with hand tools and then be promptly reinforced by glider-borne engineers carrying light equipment such as: miniature tractors, scrapers, rollers, a supply of weapons, and radio equipment. Despite their lightweight equipment, the engineers performed admirably in the deserts of North Africa, and the jungles of Burma and New Guinea.

Immediately following the American entry into the war, Aviation Engineer units were sent to England to prepare bases for the scores of planes that would soon follow. The Aviation Engineers first saw action in the deserts of North Africa. They provided important airfields for the advance across the continent and later in Sicily and Italy.

In preparation for the Normandy invasion, Headquarters IX Engineer Command was activated on 30 March 1944. Brigadier General James B. Newman was the first commander. The first units of the IX Engineer Command landed on Utah Beach on D-day and on Omaha Beach on D plus 1. An emergency landing strip was completed on Utah by 2115 on D-day. By D plus 16, five fighter-bomber groups were based in Normandy and operating from four newly constructed airfields. By V-E Day, 8 May 1945, nearly 250 airfields had been constructed or reconditioned for Allied use. During their peak period, the IX Engineer Command put an airfield into service every 36 hours.

In the Pacific and China-Burma-India theaters, Aviation Engineers constructed airfields on coconut forested-atolls and in steamy jungles, as the American forces closed in on the Japanese homeland. The engineers were often forced to abandon their construction equipment and pick up their weapons to defend their positions against the Japanese.

*A bulldozer clears a hardstand area for B-29 Superfortresses on Guam. (U.S. Air Force photo)*

During most of World War II, maintenance and repair of Army Air Forces installations was carried out by general service engineers known as post engineers. At the end of the war, 1435 airfields located in 67 foreign countries had been used, built, or improved for or by the Army Air Forces. In the Zone of Interior, 504 airfields were on an active status and 136 on a temporary inactive status.

When the Air Force became a separate service in 1947, Air Force construction continued to be programmed and budgeted by the Army Corps of Engineers. The Air Force civil engineer function operated as the Directorate of Installations under the Deputy Chief of Staff, Materiel. At the base level, the Air Installation Officer was responsible for the repair and maintenance of installation facilities, grounds, and utilities. Fire protection and aircraft crash rescue were added in 1945.

## Korean War

The Korean War presented tremendous challenges for Air Force engineers. Troop construction and bomb damage repair to Air Force facilities were accomplished by Army engineer battalions under the direction of the Air Force, known as SCARWAF (Special Category Army Personnel with the Air Force); Air Installation Officers were responsible for normal maintenance and repair at Air Force installations.

In the hectic early months of the war, engineers used pierced steel planking (PSP), a World War II innovation, as the primary expedient runway surfacing material. The urgent need for airfields and the limited construction capabilities of the SCARWAF units in Korea resulted in a tremendous requirement for PSP. Nearly 30 million square feet were used on airfields throughout the war.

During the period between World War II and the Korean War, several new aircraft were introduced into the inventory. The newer aircraft required longer and wider runways, larger taxiways and parking aprons, and more stringent design criteria for gradients, clear zones, and pavement thickness.

*An engineer repairs a runway with his heavy road grader while a C-124 Globemaster II is unloaded. (U.S. Air Force photo)*

Larger fuel storage and munitions facilities as well as more maintenance and support facilities were needed. Engineers had to accommodate ever-larger cargo aircraft and jet fighters by constructing 9,000-foot all-weather runways at Osan, Taegu, Kunsan, and Suwon. Constructing an airfield during World War II was expressed in terms of battalion days or weeks. In 1950, it was an effort expressed in terms of battalion months. Even with longer and wider runways, jet aircraft continued to be lost during takeoff and landing operations. The Air Force decided to test the application of an aircraft arresting barrier system similar to the Davis barrier used on aircraft carriers. The system adopted by the Air Force, the MA-1A, consisted of retractable stanchions that held the barrier in position and heavy anchor chain to decelerate the aircraft when it engaged the barrier. During the first six months, 36 engagements were recorded with little or no damage to the aircraft.

## A Professional Force

The 1950s were a period of significant growth in the basing of the Air Force. The elevation of the Directorate of Installations to Assistant Chief of Staff level from 1954 to 1957 was indicative of the increased engineering activities related to the massive strategic forces buildup.

With the beginning of operational planning for the ICBM, the civil engineering activity was reorganized to provide for design and construction supervision of missile ground support facilities. The designer of the missile ground environment had to work in an integrated fashion with the designer of the missile itself. When the ICBM became a part of the aerospace force, it automatically introduced engineering considerations as a major element for the selection and employment of weapon systems and resulted in an increase in the scope and volume of Air Force engineering. The construction of dispersed missile sites at various bases presented significant difficulties in the areas of operations, maintenance, and fire protection.

The design and construction of the Dye, BMEWS, and DEW Line installations presented many challenges. Extending from Greenland to Alaska, these sites were constructed under conditions that had never before been encountered and required ingenuity and perseverance to complete.

In 1954, Air Force engineers began construction of the new Air Force Academy near Colorado Springs, Colorado. The Air Force Academy Construction Agency was created to oversee the work. The new facility reflected the role that aerospace power would play in the future.

Air Force engineer leaders stressed professionalism and registration in the 1950s and 1960s. In 1959, the Air Force Director of Installations was renamed the Director of Civil Engineering. At the base level, Air Installation Officers became Installation Engineers, and finally Base Civil Engineers. This demonstrated the change in the perception of Air Force engineers from "handymen" to professionals.

## Southeast Asia

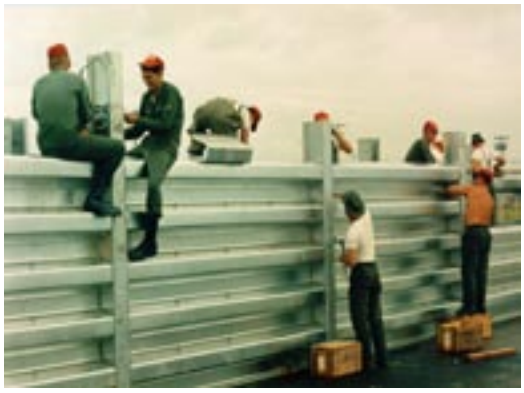
In the 1960s, Air Force Engineers responded to several emergency situations and the growing American commitment in Southeast Asia and as a result, gave the Air Force the contingency capability necessary to respond worldwide. The Lebanon crisis of 1958, Berlin crisis of 1961, and Cuban Missile Crisis of 1962 demonstrated a need for mobile civil engineer teams ready for immediate deployment to perform construction work during wartime or other emergencies. A HQ USAF study group recommended that Prime BEEF (Base Engineer Emergency Force) teams be created to respond worldwide when needed.

In the early days of the Vietnam War, large numbers of USAF strike aircraft were deployed to bases where pavement for aircraft parking was at a premium. Aircraft were parked wingtip-to-wingtip, vulnerable to an accidental explosion or enemy attack. In May 1965, a bomb accidentally exploded at Bien Hoa Air Base and the resulting accompanying explosions destroyed 40 unprotected aircraft. Three 25-man Prime BEEF teams deployed to Southeast Asia to construct protective aircraft revetments at three bases. By 1968, over 1600 personnel from nearly 60 individual Prime BEEF teams had responded to support urgent facility requirements in Southeast Asia.

*The spires of the USAF Academy Chapel take shape at the Colorado Springs site. (U.S. Air Force photo)*

However, a more long term, heavy construction and repair requirement existed to support the rapid force buildup in Southeast Asia. On 10 May 1965, Secretary of Defense Robert McNamara asked Secretary of the Air Force Harold Brown if the Air Force had the capability to construct expeditionary airfields and, if not, what could be done to develop such a capability. The response was RED HORSE (Rapid Engineer Deployable Heavy Operational Repair Squadron, Engineer). Six 400-man RED HORSE squadrons were organized and deployed to Southeast Asia by November 1966. These squadrons carried out major construction on several bases and completed much of the vertical work left undone by the contractors. RED HORSE squadrons constructed over 400 concrete aircraft shelters at six bases in South Vietnam between 1967 and 1969. The RED HORSE squadrons succeeded in making the bases much more livable for Air Force personnel.

Early in 1966, the Air Force needed another base in Vietnam. However, the existing construction capabilities were overburdened and could not guarantee completion by 1 January 1967. The Air Force decided to take on the project itself and hire its own contractor to build a base at Tuy Hoa. Using the Turnkey concept, the contractor provided the supplies, labor, and equipment to construct the base. By bringing in the material over the beach at Tuy Hoa and working day and night, the civilian contractor and the 820th RED HORSE Squadron made it possible for the base to become operational on 15 November 1966, 45 days ahead of schedule.



*A Prime BEEF team build Armco revetments at an air base in Vietnam. (U.S. Air Force photo)*

*Major Charles Lamb, left, and Maj Edwin Reinhart watch the progress of runway construction at Tuy Hoa Air Base, South Vietnam in Nov 1966. (U.S. Air Force photo)*

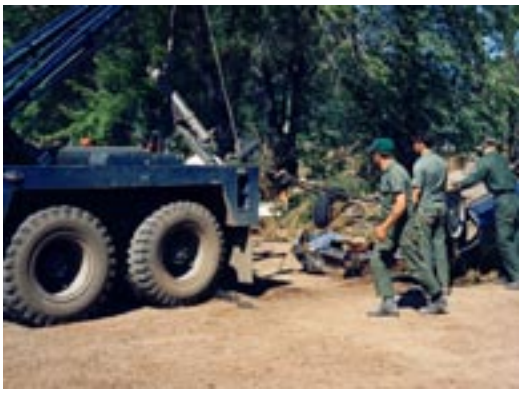
Prime BEEF teams and the 557th RED HORSE squadron deployed to South Korea in response to the rapid force buildup following the seizure of the USS Pueblo on 23 January 1968. These units constructed aircraft shelters, modular facilities, revetments, and other mission essential facilities to support the additional flying units in the country.

As American involvement in Southeast Asia began to wind down, RED HORSE capabilities were maintained at a high level of readiness. For the first time, the Air Force had organic heavy repair units designed for contingency support with no contingency at hand. In an effort to provide an engineering heavy repair capability as responsive and quickly deployed as the tactical aircraft they support, a training program was developed which produced tangible results by completing civil engineering projects which developed skills similar to those which would be required during a contingency.

One such project was the construction of an aircraft bombing and gunnery range at Blair Lakes, Alaska. The project consisted of clearing 1200 acres of forest, construction of personnel quarters, operations and maintenance buildings, and erection of 40-foot observation towers to provide a standard range for use by tactical aircraft from Alaskan Air Command. The 819th RED HORSE squadron gained valuable experience in Arctic construction operations.

## A Peacetime Force

In 1975, the Directorate of Engineering and Services was created when responsibility for mortuary affairs, housing, housing furnishings, bachelor quarters and transient quarters transferred to the Directorate of Engineering. Other Services functions such as food service were transferred in 1979 when the Air Force



*Civil engineers from nearby Ellsworth AFB help clean up after flooding at Rapid City, S.D. (U.S. Air Force photo)*

Services Office moved from the Defense Personnel Support Center, Philadelphia, PA, to HQ Air Force Engineering and Services Center (AFESC).

In 1978, Services personnel began work on the Prime RIBS (Readiness In Base Services) program to give the Services field a contingency responsibility for feeding, housing, and clothing deployed troops. By using a building block concept similar to Prime BEEF, the Prime RIBS teams provided the necessary flexibility to respond to a variety of situations. The Air Force now had the capability to properly support troops in the field.

Air Force engineers assisted local communities recovering from natural disasters. Prime BEEF and RED HORSE teams responded in Northeastern Pennsylvania and Rapid City, South Dakota, to help in the search, rescue, and recovery operations following severe flooding. A tornado devastated Xenia, Ohio, in 1974. Engineers and firefighters from Wright-Patterson AFB, Ohio, assisted in the cleanup and helped put out many fires caused by gas leaks. In 1979, the 823rd RED HORSE squadron assisted in recovery operations at Keesler AFB, Mississippi, which had been heavily damaged by Hurricane Frederick. More recently, Air Force engineers helped South Carolina and Florida residents in recovery efforts following Hurricanes Hugo and Andrew. Air Force engineers displayed both their professionalism and their human side during these massive recovery operations.

Protection and restoration of the environment became a major concern for the Air Force engineer in the 1970s. Responsibility for the Air Force environmental protection program was given to the Directorate of Engineering and Services. Terms such as Environmental Impact Statement, Installation Restoration, and pollution abatement became a part of the everyday language for Air Force engineers.

Great improvements in the quality of life for Air Force personnel were made in the 1970s. High priority was given to upgrading housing, recreational facilities, child development centers, and the workplace.

## Readiness Rebirth

The 1980s were a period of challenges for Air Force Engineer and Services personnel as engineers found themselves working on major projects overseas. Also, programs set in motion during the 1960s and 1970s, such as Prime BEEF, RED HORSE, Prime RIBS, quality of life improvements, and environmental concerns continued to expand during the 1980s.

Air Force engineers were responsible for the overall program management for the construction of two Israeli air bases in the Negev Desert. These projects presented special challenges because of the foreign government construction standards and criteria and the demanding construction schedule.

In 1979, HQ AFESC opened a Prime BEEF training facility at Eglin AFB, Florida. Prime BEEF team members received hands-on training in rapid runway repair, bomb damage repair, force beddown, Harvest Eagle equipment, chemical warfare defense, and explosive ordnance reconnaissance in a realistic contingency environment. In October 1985, the Prime BEEF contingency training conducted at Field 4, Eglin AFB, Florida, was greatly expanded. Base Recovery After Attack (BRAAT) training, an interdisciplinary approach to acquaint Prime BEEF, Disaster Preparedness, Explosive Ordnance Disposal, Firefighting, Services, and Commissary personnel with how their individual functional areas interface for a coordinated recovery effort, was initiated. For seven days, students have a chance to train and exercise together in a realistic wartime environment.

In June 1986, Prime BEEF teams from nine MAJCOMs, the Air Force Reserve, and Air National Guard met at Field 4, Eglin AFB, Florida, for the first Readiness Challenge. The 25-person teams competed in seven different events including: Vehicle Operations, Conventional Protection, Rapid Runway Repair, Minimum Operating Strip Selection, Manual Damage Assessment, Chemical Warfare Defense, and Force Beddown. Over 250 team members were given the opportunity to demonstrate their ability to support Air Force emergency operations. The Air Force Logistics Command team from the 2750th Air


*PACAF team members celebrate their victory at Readiness Challenge VI, 1997. (U.S. Air Force photo)*

Base Wing, Wright-Patterson AFB, Ohio, was the overall winner. The competition was expanded in 1987 when Services personnel were given a chance to demonstrate their wartime skills. Since 1986, Readiness Challenge has become one of the premier competitions in the Air Force.

Air Force engineers were given the opportunity to display their capabilities during SALTY DEMO, an integrated Air Base Survivability demonstration conducted in May 1985 at Spangdahlem AB, Germany. For five days, the engineers were involved in almost every aspect of BRAAT. The demonstration opened eyes and focused attention on the importance of the air base.

## A Decade of Change

Air Force Engineering and Services personnel played a vital role during the Gulf War. In August 1990, thousands of men and women began deploying to Southwest Asia in support of Operation Desert Shield/Desert Storm. Civil Engineers bedded down 55,000 people and more than 1500 aircraft at locations throughout the region. While some bases featured some of the most modern facilities, others were little more than a runway, parking ramp, and sand. Engineers erected over 5,000 tents, built more than 300,000 square feet of buildings, and laid enough asphalt to cover 120 football fields. Services personnel served more than 20 million meals throughout the operation. Engineering and Services supported the Air Force in one of the greatest military victories in American history.

Engineers have also assisted in humanitarian efforts. Following the war, engineers deployed to Turkey and Iraq to help feed Kurdish refugees during Operation Provide Comfort. In 1992, both Prime BEEF and RED HORSE personnel traveled to Somalia to "Restore Hope" for the people there. Three years later, engineers helped bed down Army personnel in Bosnia in support of Operation Joint Endeavor.

The Balkans was the scene of NATO's first conflict—Operation Allied Force. Engineers directly supported the beddown of aircraft and people at bases throughout Europe. They kept Aviano AB, Italy, operational despite severe overcrowding as thousands of troops converged no the strategically important installation. RED HORSE and Prime BEEF engineers also helped open new bases such as Rinas Airport at Tirana, Albania. As the conflict continued, a humanitarian crisis developed as Kosovar refugees flooded into Albania. Air Force civil engineers helped construct camps in Albania to house thousands of refugees. Overall, engineers supported Air Force personnel as they deployed to 21 expeditionary bases and generated 38,000 sorties without a single combat casualty.

Several organizational changes occurred during the 1990s. In February 1991, the Directorate of Engineering and Services was realigned directly under the Chief of Staff and redesignated as The Civil Engineer, an Assistant Chief of Staff. This ended a 13-year tenure under the Deputy Chief of Staff, Logistics and Engineering and returned Engineering and Services to the organizational level of the 1950s when it was known as the Assistant Chief of Staff, Installations. Later in 1991, the 16-year marriage between Engineering and Services was ended when Services merged with Morale, Welfare, and Recreation. As Services was leaving, the Explosive Ordnance Disposal and Disaster Preparedness functions joined Civil Engineering, bringing essential capabilities to the Civil Engineering team. In 1994, the functional designation Civil Engineering was shortened to Civil Engineer. At the base level, Civil Engineering squadrons became Civil Engineer squadrons.

*Engineers assemble a TEMPER Tent at a Gulf War site in 1990. (U.S. Air Force photo)*

## A New Millenium

The events of 11 September 2001 brought a new emphasis on the expeditionary nature of the US Air Force and its ability to project power anywhere around the world. Active Duty, Guard and Reserve civil engineers found themselves bedding down forces in places such as Pakistan, Kyrgyzstan, and Afghanistan in support of the Global War on Terrorism. More than 2000 engineers deployed to 13 bases, mostly in the Central Command area of responsibility to support Operation Enduring Freedom, the American effort to eliminate the terrorist breeding ground in Afghanistan. RED HORSE, firefighters, EOD and Readiness personnel were all heavily tasked. This support was not without cost, as civil engineer MSgt Evander Andrews became the operation's first American casualty, the victim of a construction accident.

As combat operations in Afghanistan wound down, Air Force civil engineers kept busy preparing bases in the CENTCOM AOR for sustained operations in Afghanistan and to set the stage for Operation Iraqi Freedom. Building up facilities at bases throughout the region aided in the preparations for combat. Bedding down people and weapons in several countries allowed the Air Force to provide superb support to the US drive to Baghdad and the destruction of the Saddam Hussein regime.

The Air Force fielded a new capability, Airborne RED HORSE teams, at several locations in Iraq. One team at Tallil, helped recover the airfield in preparation for use by forward deployed air assets, cleared over 475 acres of airfield surface, swept a 15-acre joint service beddown area, recovered 13,000 small arms rounds, destroyed over 600 Gulf War-era munitions, exploited 30 "first seen" munitions items, and established a 20-acre explosive storage area.

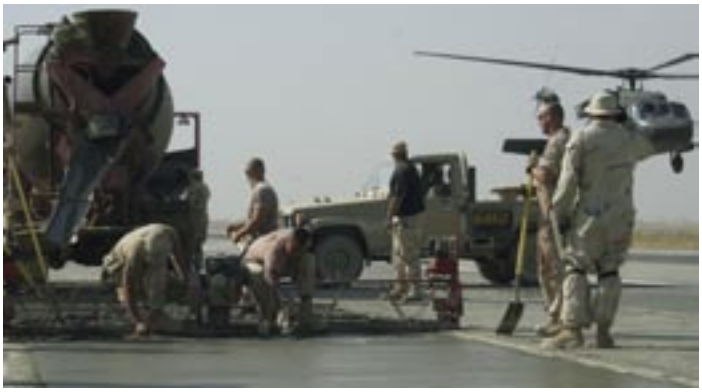
EOD troops have rendered safe thousands of munitions across Iraq and were involved in clearing 700 oil wells and gas-oil separation plants that had been rigged with explosives.

Overall, more than 4,500 engineers were deployed in support of OIF. They established 12 new bases in the region and expanded the mission on all 10 existing bases on the Arabian Peninsula. They set up 42 housekeeping sets or commercial housekeeping equivalents and supported more than 64,000 Air Force personnel, in addition to various Army, Special Operations, Marine, and coalition forces. They executed more than $329 million in construction through 211 new contracts. Engineers placed 820,000 square yards of concrete and asphalt and constructed 3.2 million square feet of contingency facilities. Air Force engineers put up 3,200 bare base tents, installed 190 miles of expedient water piping, and built 200 million gallon POL storage and distribution systems.

## Today's Challenge

Today, Air Force civil engineers are on the leading edge of technology, providing its personnel with advanced equipment and methods to perform their mission. Civil engineers give Air Force warriors a productive working environment, create neighborhoods that promote a hometown spirit, provide unmatched emergency response capabilities, and allow the Air Force to fly, fight, and win by establishing, developing, maintaining, and repairing air bases around the globe.

Building on the foundations of the past, today's men and women of Air Force civil engineering look to the future, ready to meet any challenge around the world and beyond.



*For Operation Iraqi Freedom, more than 4,500 engineers deployed to support more than 64,000 Air Force personnel, as well as Army, Special Operations, Marine, and coalition forces. (left) Staff Sgt. George Greene, 379 Expeditionary Civil Engineer Squadron structures shop, constructs a storage facility at a forward-deployed location in the Gulf region in support of Operation Iraqi Freedom. (U.S. Air Force photo by Master Sgt. Terry L. Blevins) (right) Airmen of the 455th Civil Engineer Flight work together to pour the last load of concrete for the runway as a Blackhawk helicopter flies by on the other half of the runway. (U.S. Air Force photo by Staff Sgt. Russell Wicke)*